

South Carolina Department of Health and Environmental Control

ENVIRONMENTAL AFFAIRS

SHELLFISH MANAGEMENT AREA 09A

2019 ANNUAL UPDATE

**Shellfish Sanitation Section
Environmental Affairs
2600 Bull Street
Columbia, SC 29201**

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SHELLFISH MANAGEMENT AREA 09A 2019 ANNUAL UPDATE

[Data Through December 2018]



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TABLE OF CONTENTS

Shellfish Management Area 09A Annual Update

Summary	2
Introduction.....	2
Pollution Source Survey	6
Changes in Pollution Sources	6
Survey Procedures.....	6
Point Source Pollution	6
A. Municipal and Community Waste Treatment Facilities	6
B. Industrial Waste.....	9
C. Marinas.....	9
D. Radionuclides	10
Nonpoint Source Pollution.....	10
A. Urban and Suburban Stormwater Runoff.....	10
B. Agricultural Runoff	10
C. Individual Sewage Treatment and Disposal Systems	10
D. Wildlife and Domestic Animals.....	11
E. Boat Traffic	11
F. Hydrographic and Habitat Modification	11
Naturally Occurring Pathogens	11
A. Marine Biotoxins.....	11
B. <i>Vibrio parahaemolyticus</i>	11
Hydrographic and Meteorological Characteristics	12
Water Quality Studies	13
Conclusions.....	14
Recommendations.....	14
References	16

Figures and Tables

Figures:

(1) Shellfish Growing Area Map	17
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Tables:

(1) Shellfish Water Quality Sampling Stations Description	18
(2) Fecal Coliform Bacteriological Data Summary Sheet <i>(January 01, 2016 - December 31, 2018)</i>	19
(3) Fecal Coliform Historical Trend Sheet	20
(4) Water Quality Sampling Station Data.....	21
(5) Rainfall Data <i>(January 01, 2016 - December 31, 2018)</i>	22
(6) Pollution Event Closures	26
(7) Marina Inventory.....	27

2019 ANNUAL UPDATE
Shellfish Management Area 09A

Data Inclusive Dates:

01 / 01 / 16 thru 12 / 31 / 18

Classification Change:

X Yes No

Shoreline Survey Completed: Yes

(I)ncreased/(D)ecreased/(N)one:

D Approved

N Conditionally Approved

I Restricted

N Prohibited

Prior Report & Date: 2018 Annual Update

SUMMARY

Several classification changes are recommended for this annual update of Area 09A. The upper portion of Inlet Creek surrounding Station 09A-24 over to Gentide Creek bordering Stations 09A-06 and 09A-35 will be downgraded to Restricted. Hamlin Creek at the Atlantic Intracoastal Waterway (AIWW) (Station 09A-01) to the AIWW at 25th Street, Isle of Palms will be downgraded to Restricted. The AIWW between Station 09A-19 and 09A-18 will remain in the Restricted classification.

Area 09A was impacted in October of 2016 from heavy rains and wind associated with Hurricane Matthew. Area 09A received excessive amounts of rain during the storm event which required a precautionary closure and subsequent sampling to reopen the area.

In 2017, Area 09A was impacted in August by a tropical system brought on by Hurricane Harvey bringing heavy rains which exceeded 4 inches in a 24 hour period. In September of 2017, Hurricane Irma brought heavy rains and wind to the Charleston area. Area 09A received excessive amounts of rain during these storm events which required a precautionary 21 day closure to reopen the area.

INTRODUCTION

PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47, which provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State. This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The United States Food and Drug Administration (USFDA) uses The National Shellfish Sanitation Program's (NSSP) *Guide for the Control of Molluscan Shellfish* to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria, consistent with the NSSP Model Ordinance, are used by SC Regulation 61-47, Shellfish in establishing shellfish harvesting classifications:

Approved Area - Growing areas shall be classified approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations that would render shellfish unsafe for human consumption. Approved classifications shall be determined upon a sanitary survey that includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, nor shall more than ten percent of the samples exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform MPN shall not exceed fourteen per one hundred milliliters, nor shall the estimated ninetieth percentile exceed an MPN of forty three per one hundred milliliters (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be determined using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Conditionally Approved Area - Growing areas may be classified conditionally approved when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in non-point source pollution from rainfall runoff or discharge of a major river, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as conditionally approved. Where appropriate, the management plan for each conditionally approved area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems), evaluation of each source of pollution, and means of rapidly closing and subsequently reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish shall not be directly marketed from a conditionally approved area until conditions for an approved classification have been met for a period of time likely to ensure the shellfish are safe for consumption. Shellstock from conditionally approved areas that have been subjected to temporary conditions of actual or potential pollution may be relayed to approved areas for

purification or depurated through controlled purification operations only by special permit issued by the Department.

Restricted Area - Growing areas shall be classified restricted when sanitary survey data show a moderate degree of pollution or the presence of deleterious or poisonous substances to a degree that may cause the water quality to fluctuate unpredictably or at such a frequency that a conditionally approved classification is not feasible. Shellfish may be harvested from areas classified as restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. The suitability of restricted areas for harvesting of shellstock for relay or depuration purposes may be determined through the use of comparison studies of background tissue samples with post-process tissue samples, as well as other process verification techniques deemed appropriate by the Department. For restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters nor shall more than ten percent of the samples exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Conditionally Restricted Area - Growing areas may be classified conditionally restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as conditionally restricted. Where appropriate, the management plan for each conditionally restricted area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems and an evaluation of each source of pollution, and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as conditionally restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For conditionally restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of conditionally restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters nor shall more than ten percent of the samples exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of two hundred and sixty per one hundred milliliters (five tube decimal dilution). Computation of the estimated

ninetieth percentile shall be obtained using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Prohibited Area - Growing areas shall be classified prohibited if there is no current sanitary survey report or if the sanitary survey report or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or otherwise indicate that such substances could potentially reach quantities that could render shellfish unfit or unsafe for human consumption.

BACKGROUND INFORMATION

This sanitary survey evaluates the current harvesting classification of shellfish growing waters designated as Shellfish Management Area 09A (Area 09A). Area 09A consists of approximately 7,044 acres of shellfish growing area habitat located in Charleston County, South Carolina. The area consists of the Atlantic Intracoastal Waterway (AIWW) and four main creeks: Conch, Hamlin, Inlet and Swinton. Area 09A extends in a generally northeast to southwest direction, from approximately one quarter mile south of Morgan Creek to the Charleston Harbor. The northern boundary is an imaginary line extending from 41st Avenue on the Isle of Palms, through Gray Bay, to the Mount Pleasant mainland near Six Mile Road. US Highway 17 defines the area's western boundary. The southern boundary is the Charleston Harbor. The eastern boundary consists of the Atlantic Ocean shoreline of the Isle of Palms and Sullivan's Island.

The shellfish industry in South Carolina is based primarily on the harvest of the eastern oyster (*Crassostrea virginica*) and hard clams, which include both the northern clam (*Mercenaria mercenaria*) and several small populations of the southern clam (*Mercenaria campechiensis*). The ribbed mussel (*Geukensia demissa*) is also harvested in South Carolina on a small scale, primarily recreationally. Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include State Shellfish Grounds, Culture permits, Mariculture permits and Kings Grant areas. The South Carolina Department of Health and Environmental Control will disallow the harvesting of shellfish within Area **09A**, for direct marketing purposes, from the restricted waters listed below in the Recommendations.

There are six State Shellfish Grounds (S) within Area 09A: S217, S222, S251, S252, S254 and S255. Additionally, two Recreational Shellfish Grounds (R) are located in Area 09A: R234 encompasses Gray Bay, while R252 consists of upper Hamlin Creek and its adjacent marshland. Three King's Grant (G) are located in Area 09A: G219, G247, and G253. There are numerous Culture Permit (C) and Mariculture Permit (M) leases throughout the area.

The wild-stock shellfish harvesting season in South Carolina extends from October through May **of** the following year. The SCDNR has the authority to alter the shellfish-harvesting season for resource management purposes and grant permits for year-round mariculture operations. Additionally, the South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that shellfish harvested in South Carolina waters are safe for human consumption.

The harvesting classifications of Area 09A **prior** to this sanitary survey were as follows:

PROHIBITED

1. The AIWW, from the border with Area 08 approximately 1,000 feet south;
2. Hamlin Creek, the full width of the creek extending approximately 1,565 feet to the north and 939 feet to the south of Two Island Marina/Long Island Yacht Harbor (based upon Division of Water Quality modeling dated 03/15/2002);
3. The Cove, along Sullivan's Island, between Charleston Harbor and the Ben Sawyer Bridge (Station 09A-09).

RESTRICTED

1. The Atlantic Intracoastal Waterway (AIWW) between Station 09A-19 and 09A-18.

CONDITIONALLY APPROVED

None

APPROVED

All other waters of Area 09A.

Station Additions/Deactivations/Modifications: None

POLLUTION SOURCE SURVEY

CHANGES IN POLLUTION SOURCES

No substantial changes in pollution sources have occurred in Area 09A since the **2018** Annual Report.

SURVEY PROCEDURES

Shoreline surveys of Area 09A are conducted by the Lowcountry Charleston Shellfish Program staff by watercraft, vehicle, and on foot, during the survey period and are ongoing.

POINT SOURCE POLLUTION

- A. Municipal and Community Waste Treatment Facilities** - The Mount Pleasant Waterworks (SC0040771) operates two wastewater treatment plants (WWTP) within Area 09A, one located on Rifle Range Road and the other located on Center Street. Neither of these facilities discharge to Area 09A waters, their discharge is to the Charleston Harbor (Outfall 005) in Area 10B as well as various land applications (Outfalls 006-008). The town of Sullivan's Island WWTP (SC0020052) discharges to Cove Creek (Outfall 001), into the Administratively Prohibited waters immediately

adjacent to Ben Sawyer Boulevard. Isle of Palms has two wastewater treatment plants. The Forest Trails WWTP (SC0025283), located on Isle of Palms, discharges treated effluent into the AIWW adjacent to 41st Avenue (Outfall 001) and land applies to the Wild Dunes Beach and Racquet Club Golf Course (Outfall 002). The Wild Dunes WWTP (ND0062260) does not have a direct discharge into shellfish waters. The facility utilizes extended aeration with a holding pond and the treated effluent is land applied to the Wild Dunes Links and Harbor Golf Course (Outfall 001) and on 2 acres at the Forest Trails WWTP itself (Outfall 003). Refer to the Shellfish Growing Area 09A map included in this report. Additionally, the Isle of Palms (SC0043583) and Mount Pleasant Waterworks (SC0043273) both operate Reverse Osmosis (RO) water treatment plants within the area, however there is no fecal coliform component associated with the effluents. Mount Pleasant Waterworks discharges to the Lower Wando in Area 9B. Isle of Palms discharges to Lower Hamlin Creek.

National Pollutant Discharge Elimination System (NPDES) Permitted Facilities			
Permit #	Facility	Outfalls	Permitted Flow (Gallons Per Day)
SC0040771	Mt. Pleasant WWTP	005-Chas. Harbor (Combined outfalls 001-004) 006-Land App. (Sloan Park) 007-Land App. (Center St. Ballfield) 008-Land App. (Commissioners Ops. Center)	9,570,336 GPD
SC0020052	Sullivan's Island WWTP	001-Discharge to AIWW via Cove Creek	563,600 GPD
SC0025283	IOP Forest Trails WWTP	001-Discharge to AIWW 002-Land App. (Golf Course)	300,000 GPD
ND0062260	IOP Wild Dunes WWTP	001-Land App. (Golf Course) 002-Discharge to Forest Trails 003-Land App. (WWTP)	1,070,000 GPD
SC0043583	Isle of Palms Reverse Osmosis	001-Unnamed tributary to Lower Hamlin Creek	N/A
SC0043273	Mt. Pleasant Reverse Osmosis	001-Unnamed tributary to Cooper River in Area 10B	N/A

The table below summarizes all instances where WWTP facilities exceeded their allowed permit values for fecal coliform, the Discharge Monitoring Report (DMR) value of that violation, and flow value. For the 2016-2018 reporting years for this Annual Update, there were one instance of permit violation for fecal coliform parameters.

WWTP Discharge Monitoring Report Violations 2016-2018					
Facility	Limit	Violation	Outfall	Report Date	Monthly Avg. Flow (Gallons Per Day)
Mt. Pleasant WWTP	200 FC/100 ml	None			
	400 FC/100 ml	None			
Sullivan's Island WWTP	501 E.Coli/100 ml	None			
	14 FC/100 ml	None			
	43 FC/100 ml	None			
IOP Forest Trails WWTP	14 FC/100 ml	None			
	43 FC/100 ml	None			
IOP Wild Dunes WWTP	14 FC/100 ml	None			
	43 FC/100 ml	None			

The town of Isle of Palms wastewater collection system, serviced by the Forest Trails WWTP and Wild Dunes WWTP, had three reported sanitary sewer overflows (SSO's) for 2016-2018. The town of Mount Pleasant wastewater collection system had one reported SSO's for 2016-2018 that affected Growing Area 9A. The town of Mount Pleasant had seventeen additional SSO's that did not impact Growing Area 9A.

Sanitary Sewer Overflows 2016-2018				
Mt. Pleasant				
Date	Location	Gallons Released	Waterbody Entered	Growing Area
2/21/2016	3157 Hwy 17 N	200	Retention Pond	NA
3/5/2016	Hubbell Dr.	Unknown	Retention Pond	NA
6/6/2016	Whipple Road	4,000	Retention Ponds	10B
6/10/2016	Bessemer Rd.	200	Retention Pond	NA
6/11/2016	526 Stratton Ferry Ct.	2000	Retention Pond	NA
10/8/2016	660 Pawley Rd	Unknown	Shem Creek	10B
10/8/2016	Cottingham Drive	Unknown	Shem Creek	10B
10/8/2016	Center St	Unknown	Creek Adjacent To Pitt St	9A
10/8/2016	481 Long Point Road	Unknown	Hobcaw Creek	10B
5/9/2017	1285 Waterfront Drive	Unknown	Two Retention Ponds	9A
6/6/2017	Entrance To Park West	47,000	Ditch Leading To Marsh And Copahee Sound	8/9A
7/13/2017	Long Pt. Road & Spann St	3,000	Retention Pond	NA

8/28/2017	Ps#47 Whipple Road	5,000	Retention Pond	9A
10/13/2017	Wando Park Blvd	2,000	Retention Pond	
3/31/2018	Rice Hope Dr	4,081	Boone Hall Creek	10B
4/3/2018	Corner Of Darrell Creek Trail And Commonwealth Rd	800	Alston Creek	9B
9/28/2018	1054 Anna Knapp Blvd	360	Shem Creek	10B
Isle of Palms				
10/8/2016	70 Morgan Place Drive	6000	Lagoon	NA
10/8/2016	4008 Waterway Blvd	2,000	AIWW	8
11/15/2018	117 Sparrow Lane	500	Na	NA
Deweese Island				
N/A				

Available hydrographic information suggests a possible impact from sources located outside the growing area. The area from the Charleston Harbor extending northeast to the Ben Sawyer Bridge appears to be impacted during certain hydrographic conditions by waters originating in the Charleston Harbor (Cleveland, 1967). Effluent from wastewater treatment plants discharging into the harbor may be impacting extreme southwestern portions of Area 09A. Flow calculations have established time and distance of travel and place the effluent plumes within the Cove at Sullivan's Island. Due to public health concerns, southwestern portions of Area 09A from Ben Sawyer Boulevard to the Charleston Harbor will remain Administratively Prohibited.

- B. Industrial Waste (Discharges)** - Currently there are no operational industrial wastewater discharges located within the boundaries of Area 09A.
- C. Marinas** – In 2007, prompted by a SCDHEC Office of Coastal Resource Management (OCRM) marina definition change, SCDHEC Shellfish adopted the following marina definition. S.C. Regulation 61-47, Shellfish defines *Marina* as any of the following: (1) locked harbor facility; (2) any facility which provides fueling, pump-out, maintenance or repair services (regardless of length); (3) any facility which has effective docking space of greater than 250 linear feet or provides moorage for more than 10 boats; (4) any water area with a structure which is used for docking or otherwise mooring vessels and constructed to provide temporary or permanent docking space for more than ten boats, such as a mooring field; or (5) a dry stack facility.

Prior to the 2007 definition change, there were three recreational marinas located within Area 09A. Two of these facilities, Two Island Marina and Long Island Yacht Harbor, are located adjacent to Breach Inlet. Combined, these two marinas typically accommodate approximately 55 boats. Neither fuel nor sewage pump-out services are provided at either marina. An Administratively Prohibited closure zone has been established around these two marinas. Additionally, Toler's Cove is located west of the AIWW, adjacent to the south side of the Ben Sawyer Boulevard. This recreational marina provides rental slips to the boating public as well as slips for condominium/homeowner use. It has 143 wet slips and 9 jet-ski docks and provides both diesel and gasoline fueling services and wastewater pump-out services. Toler's Cove is located entirely within the Administratively

Prohibited area south of Ben Sawyer Boulevard. Table #6 is included at the end of this report, providing additional detail on Area 09A boat docking facilities.

As of yet, SCDHEC has not identified any other facilities meeting the new marina definition. If identified, they will be mapped and adequate closure zones established to protect public health.

- D. Radionuclides** - Sources of radionuclides have not been identified within Area 09A, and radionuclide monitoring has not been conducted. No other sources of poisonous or deleterious substances have been identified within the area.

NONPOINT SOURCE POLLUTION

- A. Urban and Suburban Stormwater Runoff** - Previous shoreline surveys conducted in Area 09A revealed a high concentration of homes throughout most uplands adjacent to the shellfish growing area. Single-family homes continue to be built along the mainland shores as well as on Goat Island, Sullivan's Island, Isle of Palms and Toler's Cove. Stormwater runoff may adversely impact shellfish water quality by transporting fecal coliform bacteria from land to the shellfish growing area.

There are three dredge spoil areas located along the AIWW between Hamlin Creek and Inlet Creek. The Army Corps of Engineers conducted a dredging project within Area 09A on the AIWW in December 2015 to restore the waterway to navigable depths.

The uplands surrounding the shellfish growing waters of Area 09A consist of various soil textures defined by the United States Department of Agriculture (USDA), Soil Conservation Service (1971) utilizing general classifications and descriptions. Although lands within Area 09A consist of numerous soil types, the area is generally comprised of Rutlege-Scranton-Pamlico soils, made up of low, broad flats and long, nearly level, sandy ridges. The area is interlaced with the Chipley series; which is loamy, fine sand. The USDA (1971) further describes these soils as "somewhat poorly drained to very poorly drained, nearly level to depressional, sandy and mucky soils."

- B. Agricultural Runoff** - There are no permitted agricultural facilities located in Area 09A. The uplands and barrier islands of Area 09A are all heavily developed, either residentially or commercially, with little to no agricultural activity. The lack of concentrated agricultural activity near the shoreline of the growing waters precludes contamination of shellfish waters from agricultural runoff.
- C. Individual Sewage Treatment and Disposal Systems** - Homes adjacent to shellfish growing waters on Isle of Palms and Sullivan's Island are all served by sanitary sewer. Goat Island, located between Isle of Palms and Gray Bay, is served solely by individual septic systems. Isle of Palms and Goat Island are of special concern, as all water sampling stations near these two areas in Area 09A have, at one time or another, been impaired (see Table #3). On Isle of Palms, many of the yards of homes on septic systems are prone to flooding after heavy rainfall, and the Isle of Palms Fire Department has been

observed on previous occasions using their trucks to pump the floodwaters out of streets and yards, either onto the beach or into the AIWW behind the island. Standing floodwaters over septic tile fields would be a considerable source of fecal coliform bacteria being introduced into shellfish growing waters.

Cassina Plantation also has approximately 33 homes on individual septic systems. This area is near station 09A-24 in upper Inlet Creek. Each septic system requires inspection and approval by the Bureau of Environmental Health, Lowcountry Charleston Health District, prior to operation.

- D. Wildlife and Domestic Animals** - Area 09A supports a large population of domestic animals attributable to the number of private residences along the shores of Mount Pleasant, Isle of Palms, Sullivan's Island and Goat Island and are a likely contributor to fecal coliform levels in the Area. The Area also supports moderate wildlife populations, primarily various types of marine water birds typical of coastal South Carolina. The water birds are present all year in the area, however, are in higher concentrations during the summer months because of migratory nesting season, and may contribute minimally to fecal coliform levels at that time.
- E. Boat Traffic** - Recreational boat traffic is heavy in the area throughout the year. Commercial traffic in the AIWW is moderate and consists primarily of tugs and barges. Commercial fisheries boats, primarily shrimpers and crabbers ranging in size from 16 to 50 feet, operate in accordance with seasonal fisheries. During the recreational shrimp-baiting season, typically extending from mid-September through mid-November, recreational traffic is very heavy.
- F. Hydrographic and Habitat Modification** - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. Portions of the AIWW require maintenance dredging. The U.S. Army Corps of Engineers utilizes designated tracts of land adjacent to the AIWW as dredge spoil sites.

NATURALLY OCCURRING PATHOGENS

- A. Marine Biotoxins** - Bivalve shellfish contamination from marine biotoxins has not been shown to be a human health concern within Area 09A. During the winter and spring of 1988, South Carolina experienced an occurrence of "Red Tide", specifically *Ptychodiscus brevis* (*K. brevis*), which affected water quality in Area 01. There has been no documented reoccurrences of this organism at levels requiring emergency response in South Carolina waters subsequent to the 1988 event. Due to the vast media coverage of events related to *Pfiesteria piscicida*, the Department participates in a State Task Group on Toxic Algae and operates a toxic algae emergency response team.
- B. *Vibrio parahaemolyticus*** – Because State water temperatures exceed 81 degrees Fahrenheit (F) during June through September, *Vibrio parahaemolyticus* (Vp) management controls must be implemented during these months. Management controls for permitted Aquaculture facilities are specifically addressed in R.61-47. The season for

wild-stock harvest is currently closed from May 16 through September 30. The Department is currently opposed to issuance of special wild-stock harvest permits to Certified Shippers during the closed season. Special permit conditions for maricultured triploid oysters during the vibrio control months must include current R.61-47 and NSSP temperature control requirements to be included in the Certified Shipper's HACCP plan.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

Area 09A is comprised of tidal creeks, shallow bays and associated tidal marshlands. The creeks within the area range from 20 to 300 feet in width. Maximum depths approach approximately 20 feet. Additionally, the AIWW traverses the area's entire length in a northeasterly-southwesterly direction. The AIWW is maintained at a mean low water depth of 12 feet by the US Army Corps of Engineers. The major conduits of water flowing into and out of the area are: the AIWW on the northeastern border, Breach Inlet, between Sullivan's Island and the Isle of Palms which defines the eastern extent of the area, and, during low river flow conditions, the Charleston Harbor on the southwestern border. The influence of high-salinity ocean water, entering the area via these inlets, provides high flow and a subsequent flushing action that assists in moderating the affects of rainfall runoff on water quality. The entire area is approximately four miles wide (northwest to southeast) and seven miles long (southwest to northeast).

Tides in Area 09A are semidiurnal, consisting of two low and two high tides occurring each lunar day. Mean tidal ranges in Hamlin Creek along the Isle of Palms are 5.1 feet during normal tides and 6.7 feet during spring tides. Wind direction and intensity, as well as atmospheric pressure, typically cause variations in predicted tidal ranges.

Precipitation in Area 09A is heaviest during late summer and early autumn. Tropical storms and hurricanes occasionally produce extremely large amounts of rainfall. During winter months heavy rainfall events are uncommon, yet occasional intense thunderstorms associated with rapidly moving low-pressure systems generate heavy rains. Precipitation rarely occurs in the form of snow or ice. Spring weather patterns may be dynamic with associated thunderstorms and severe weather conditions.

On October 8, 2016, Hurricane Matthew made landfall southeast of McClellanville, SC. Shellfish harvest was closed by SC DHEC prior to the arrival of the storm. Hurricane Matthew dropped considerable amounts of precipitation in the Charleston area and had a storm surge that caused extensive flooding. SC DHEC reassessed the closures after the storm and conducted sampling prior to reopening the growing areas. Water sampling was used to reopen the beds once fecal coliform concentration levels were low enough to permit harvest. The widespread flooding also caused sanitary sewer overflows into harvestable shellfish areas, requiring 21 day closures and additional tissue samples prior to reopening. The 2018 precipitation total recorded by the National Weather Services's Southeastern River Forecast Center was 61.97 inches.

In 2017, the collection of rainfall data has been improved for a more consistent, accurate, and reliable data set that can be accessed directly from a shellfish staff member's computer or phone. With assistance from the National Weather Service's, Southeastern River Forecast Center, the development of the South Carolina Shellfish Rainfall Program was introduced and

utilized. This new technology provides shellfish program staff with real-time daily updates for rainfall accumulation in each of the South Carolina shellfish growing management areas, as well as providing critical triggers that alert staff to when rainfall thresholds for closures are exceeded.

Prevailing winds along the central portion of the South Carolina coast are from the south and west during spring and summer and from the north during autumn and winter. Wind speeds are generally less than 15 miles per hour (mph); however, strong weather systems may generate winds in excess of 25 mph. Tropical storms and hurricanes occur occasionally.

Freshwater rivers do not discharge directly into Area 09A. Freshwater influence is primarily due to rainfall, although, during periods of high flow in the Cooper River, brackish water may enter via Charleston Harbor.

WATER QUALITY STUDIES

DESCRIPTION OF THE PROGRAM

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 09A in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July 1998, an updated shellfish water quality data scheduling and collection procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station, yet provides a six-sample “cushion” (above the NSSP required 30 minimum) for broken sample bottles, lab error, breakdowns, etc. This also allows each annual report’s water quality data to meet the requirements for the NSSP Triennial Review sampling criteria.

Eight-hundred four (804) SRS surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses and classification purposes from twenty-three (23) active water quality sampling stations in Area 09A during the period 01/01/16 through 12/31/18. Additionally, many special bacteriological samples were collected during the review period for non-classification purposes, usually associated with reopening the area following a precautionary closure. The samples utilized for this report were collected in 120 ml amber glass bottles, immediately placed on ice and transported to the South Carolina Department of Health and Environmental Control’s Lowcountry Charleston Environmental Affairs laboratory at North Charleston, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. At the laboratory, sample sets exceeding a 30-hour holding time or containing a temperature control in excess of 10 degrees Celsius were discarded (APHA, 1970).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using an automatic temperature compensated refractometer. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling.

MONITORING RESULTS

Fecal coliform data summaries are provided in Table #2. Twenty-three (23) stations have the minimum number of thirty (30) samples required for classification. No station exceeds a fecal coliform geometric mean MPN value of 14. Stations, 09A-18, 09A-19 & 09A-24 exceeded a fecal coliform geometric mean MPN value of 43.

Area 09A was closed on 10/07/2016 prior to landfall of Hurricane Matthew. Ten (10) special samples collected on 10/17/2016 were used to reopen the Area on 10/19/2016.

CONCLUSIONS

Available hydrographic information suggests a possible impact from sources located outside the growing area. The area from the Charleston Harbor extending northeast to the Ben Sawyer Bridge appears to be impacted during certain hydrographic conditions by waters originating in the Charleston Harbor (Cleveland, 1967). Effluent from wastewater treatment plants discharging into the harbor may be impacting extreme southwestern portions of Area 09A. Flow calculations have established time and distance of travel and place the effluent plumes within the Cove at Sullivan's Island. Due to public health concerns, southwestern portions of Area 09A from Ben Sawyer Boulevard to the Charleston Harbor will remain Administratively Prohibited.

Based on review of fecal coliform bacteriological data and the pollution source survey, Area 09A is primarily impacted by one source of actual or potential pollution.

NONPOINT SOURCE RUNOFF

Stormwater runoff continues to be the major source of fecal coliform bacteria throughout the area. Moderate animal populations, both domestic and wild, likely impact water quality in the area. Nearly all of the upland shoreline has waterfront residential property directly along the marsh. Development in close proximity to shellfish harvesting waters is a likely contributor to lower water quality within the area. Overland runoff in Area 09A, however, appears to be mitigated by coastal ocean water entering the estuary through Breach Inlet.

RECOMMENDATIONS

After analysis of this year's data, it is recommended that two changes be made to the classifications in Area 09A. The upper portion of Inlet Creek surrounding Station 09A-24 over to Gentide Creek bordering Stations 09A-06 and 09A-35 will be downgraded to Restricted. Hamlin Creek at the Atlantic Intracoastal Waterway (AIWW) (Station 09A-01) to the AIWW at 25th Street, Isle of Palms will be downgraded to Restricted. The Atlantic Intracoastal Waterway (AIWW) between Station 09A-19 and 09A-18 will remain downgraded to Restricted. All

administratively closed areas will remain in the Prohibited Classification and all other waters in Growing Area 09A will remain classified as Approved.

The following harvesting classifications for Area 09A are recommended:

PROHIBITED

1. The AIWW, from the border with Area 08 approximately 1,000 feet south;
2. Hamlin Creek, the full width of the creek extending approximately 1,565 feet to the north and 939 feet to the south of Two Island Marina/Long Island Yacht Harbor (based upon Division of Water Quality modeling dated 03/15/2002);
3. The Cove, along Sullivan's Island, between Charleston Harbor and the Ben Sawyer Bridge (Station 09A-09).

RESTRICTED

1. The upper portion of Inlet Creek surrounding Station 09A-24 over to Gentide Creek bordering Stations 09A-06 and 09A-35;
2. Hamlin Creek at the Atlantic Intracoastal Waterway (AIWW) (Station 09A-01) to the AIWW at 25th Street, Isle of Palms (09A-19);
3. The Atlantic Intracoastal Waterway (AIWW) between Station 09A-19 and 09A-18.

CONDITIONALLY APPROVED

None

APPROVED

All other waters of Area 09A.

Station Additions/Deactivations/Modifications: None

Analysis of sampling data for Area 09A demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24-hour period. Therefore, a precautionary closure of Area 09A will be implemented following rainfall events of greater than 4.00" in a 24-hour period, as measured at the Mount Pleasant Waterworks, Rifle Range Road facility located in Mount Pleasant. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). The National Weather Service publishes PMP estimates for the coastal United States in a series of hydro-meteorological reports (HMRs) (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National Research Council, 1985*)

REFERENCES

American Public Health Association, Inc. *Procedures for the bacteriologic examination of sea water and shellfish*, 1970. p. 28-47. In *Recommended procedures for the examination of sea water and shellfish*, 4th ed. Library of Congress, Washington, D.C.

Cleveland, E. G., 1967. *Sullivan's Island - Isle of Palms hydrographic study*. United States Department of Health, Education and Welfare, Public Health Service, Region IV, Atlanta GA.

National Research Council, 1985, *Safety of Dams - Flood and Earthquake Criteria* National Academy Press, Washington DC.

National Shellfish Sanitation Program (NSSP), Guide for the Control of Molluscan Shellfish, 2017 Revision. Model Ordinance. United States Food and Drug Administration.

<https://www.fda.gov/media/117080/download>

National Weather Service. The National Oceanic and Atmospheric Administration. *Precipitation Frequency Atlas of the Western US: NOAA Atlas II*. Superintendent of Documents, US Government Printing Office - Washington DC.

South Carolina Department of Health and Environmental Control (SCDHEC), Bureau of Water, 2017, Regulation 61-47, Shellfish. p.9-12.

<https://www.scdhec.gov/sites/default/files/media/document/R.61-47.pdf>

United States Department of Agriculture, Soil Conservation Service, 1971. *Soil survey of Charleston County, South Carolina*. In cooperation with South Carolina Agricultural Experiment Station and South Carolina Land Resources Conservation Commission, National Cooperative Soil Survey, Washington, D.C. p. 78.

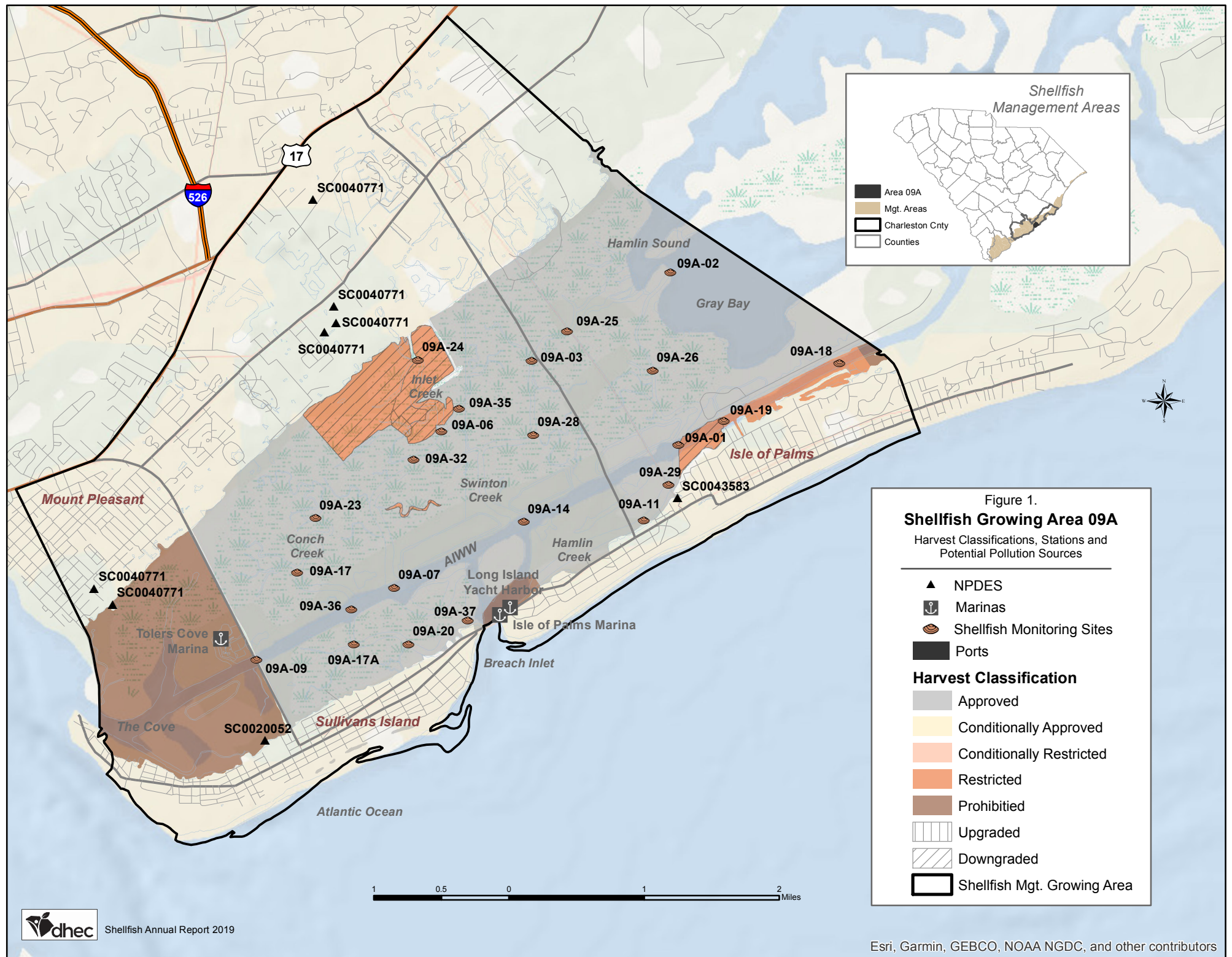


TABLE #1
Shellfish Management Area 09A
Water Quality Sampling Stations Description

<u>Station</u>	<u>Description</u>
09A-01	Hamlin Creek at the AIWW
09A-02	Upper Hamlin Creek at Gray Bay
09A-03	Upper Swinton Creek at fork north of Station 9A-28
09A-06	Upper Inlet Creek at Gentide Creek
09A-07	Inlet Creek at the AIWW
09A-09	AIWW at SC Hwy 703 bridge (Ben Sawyer Bridge)
09A-11	Lower Hamlin Creek at 10th Street, Isle of Palms
09A-14	Swinton Creek at the AIWW
09A-17	Upper Conch Creek at fork
09A-17A	Lower Conch Creek at fork
09A-18	AIWW at Wild Dunes Golf Course storm drainage outfall
09A-19	AIWW at 25th Street, Isle of Palms
09A-20	Lower Conch Creek at Lofton Creek
09A-23	Upper Conch Creek at second fork
09A-24	Upper Inlet Creek at sharp bend above Station 9A-06 near causeway
09A-25	Upper Swinton Creek at SC Hwy 517 bridge (IOP Connector)
09A-26	Upper Hamlin Creek midway between Stations 9A-01 and 09A-02
09A-28	Upper Swinton Creek at second bend
09A-29	Lower Hamlin Creek at SC Hwy 517 bridge (IOP Connector)
09A-32	Upper Inlet creek at first creek downstream of Station 9A-06
09A-35	Gentide creek at the power lines
09A-36	Conch Creek at the AIWW
09A-37	Lower Conch Creek at Breach Inlet

(Total Active – 23)

TABLE #2

**Shellfish Management Area 09A
Fecal Coliform Bacteriological Data Summary
From Shellfish Water Quality Sampling Stations Between
January 1, 2016 and December 31, 2018**

Station #	01	02	03	06	07	09	11	14	17	17A
SAMPLES	35	34	35	35	35	35	35	35	35	35
GEOMEAN	3.5	2.4	4.9	5.8	3.1	4.3	4.1	3.1	4	3.2
90TH %ILE	12	5	34	31	12	20	13	12	24	12
WATER QLTY	A	A	A	A	A	A	A	A	A	A
CLASSIFICATION	R	A	A	R	A	P	A	A	A	A

Station #	18	19	20	23	24	25	26	28	29	32
Samples	35	35	35	35	35	35	35	35	35	35
GEOMEAN	12.2	7.4	3.1	5	7.3	4.1	3.7	3.2	4.9	4.9
90TH %ILE	182	51	14	39	45	28	9	13	15	26
WATER QLTY	R	R	A	A	R	A	A	A	A	A
CLASSIFICATION	P	R	A	A	R	A	A	A	A	A

Station #	35	36	37
SAMPLES	35	35	35
GEOMEAN	4.3	3.5	3.3
90TH %ILE	19	15	10
WATER QLTY	A	A	A
CLASSIFICATION	R	A	A

A - Approved **CA** - Conditionally Approved **R** – Restricted
RND - Restricted/No Depuration **P** – Prohibited

Table #3 Fecal Coliform Historical Trend Sheet											
Area 09A Stations 90 th ile Values for Annual Updates Related to Rainfall											
Station #	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
09A-01	12	15	11	16	11	17	16	33	36	41	68
09A-02	5	4	4	5	5	5	3	4	6	9	9
09A-03	34	26	6	9	11	11	10	12	15	19	37
09A-06	31	20	8	9	9	10	8	13	15	17	18
09A-07	12	7	4	8	8	8	4	9	10	14	15
09A-09	20	15	8	13	13	13	7	14	17	29	39
09A-11	13	13	7	10	12	20	20	28	22	23	23
09A-14	12	10	3	6	7	7	7	10	11	15	17
09A-17	24	18	6	14	12	12	6	14	21	30	42
09A-17A	12	10	5	11	10	11	9	17	20	19	37
09A-18	182	98	50	39	31	42	24	25	23	32	85
09A-19	51	23	12	15	18	25	22	28	24	29	35
09A-20	14	12	5	6	6	7	10	22	33	33	44
09A-23	39	21	7	18	15	20	13	33	38	42	53
09A-24	45	27	10	20	16	19	10	31	37	35	45
09A-25	28	20	6	9	9	12	8	11	16	23	25
09A-26	9	6	5	7	10	10	7	6	8	12	13
09A-28	13	10	4	7	8	10	6	10	13	17	25
09A-29	15	13	12	17	19	22	17	21	22	22	39
09A-32	26	15	7	6	6	7	4	9	10	14	22
09A-35	19	10	5	10	11	15	9	13	13	17	20
09A-36	15	12	8	10	9	10	9	13	14	15	29
09A-37	10	10	7	8	8	9	8	15	18	19	18
Annual Rainfall (in inches)	61.97	63.24	41.47	72.27	50.65	61.14	34.45	31.89	50.1	59.48	47.7
ND = No Data Red = Impaired Water Quality											

TABLE #4

WATER QUALITY SAMPLING STATIONS DATA

Shellfish Management Area 9A

Detailed data for each shellfish station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports, can be obtained through South Carolina's Department of Health and Environmental Control – Freedom of Information office at the address below.

Freedom of Information
Dept. of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

TABLE #5

RAINFALL DATA

Shellfish Management Area 09A

Source:

2016 Data:

*Mount Pleasant Waterworks & Sewer Commission & SCDHEC Rainfall Monitoring Station
Location: Mount Pleasant, South Carolina*

2017-2018 Data:

*National Weather Service, Southeastern River Forecast Center
Location: Charleston, South Carolina*

2016 Annual Rainfall Summary
Source: South Carolina Department of Health and Environmental Control
Data Logger Location: Mt. Pleasant, S.C.

2016	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1	0.39	0	0	0.35	0	0	1.31	0.13	0.13	0	0	0.07
2	0	0	0	0.23	0	0	0	0	0	0	0	0
3	0	1.08	0.46	0	0.47	0	0	2.11	0	0	0	0
4	0	1.93	0.7	0	0.02	0	0	0	0	0	0	0
5	0	0	0	0	0	0.02	0	0	0	0	0	0.22
6	0	0.41	0	0	0	1.75	0.57	0	0	0	0	0.28
7	0	0.92	0	0	0	0.67	0	0	0	3.2	0	0.23
8	0.03	0.07	0	0	0	0	0	0.15	0	0	0	0.18
9	0	0	0	0	0	0	0	0	0	0	0	0.04
10	0.01	0	0	0	0	0	0	0.01	0	0	0	0.13
11	0	0	0	0	0	0	0	0	0	0	0	0.25
12	0	0	0	0.06	0	0	0	0	0	0	0	0.08
13	0	0	0	0	0.05	0	0	0	0.87	0	0.18	0.01
14	0	0	0	0	0	0	0	0	0.02	0	0	0.03
15	1.18	0.43	0	0.51	0	0	0	0	0.11	0	0	0.02
16	0	0.66	0	0.01	0	0.01	0	0	0	0	0	0.02
17	0.72	0	0	0	0.54	0.55	0.71	0	0	0	0	0.01
18	0	0	0.11	0	0.01	0.01	1.08	0.16	0	0	0	0.09
19	0	0	0	0	0.19	0	0.01	0	0	0	0	0.06
20	0	0	0.04	0	0.08	0	0	0.01	0	0	0	0.03
21	0	0	0	0	0.01	0	0	0	0	0	0	0.02
22	1.74	0	0	0.09	0	0	0	0	0	0	0	0.03
23	0.01	0.36	0	0	0	0	0	0	0.58	0	0	0
24	0	0.07	0	0	0	0	0	0	0	0	0	0
25	0	0.01	0	0	0	0	0	0	0	0	0	0
26	0	0	1	0	0	0	0	0	1.41	0	0.01	0.01
27	0	0	1.64	0	0	0	0	0	0.09	0	0	0.01
28	0.17	0	0.04	0.05	2.67	0.25	0	0.01	0	0	0	0.01
29	0.01	0	0	0	0.8	2.14	0	0.03	0	0	0.02	0.02
30	0		0	0	0.17	0	0	0.14	1.21	0	0	0
31	0		0.08		0.04		0	0.84		0		0.18
Total	4.26	5.94	4.07	1.30	5.05	5.4	3.68	3.59	3.01	3.2	0.21	2.03
*Days highlighted indicate 4 or more inches of rain in a 24 hour period.												
* Sample dates are indicated in blue.								ANNUAL RAINFALL		41.74		

2017 Annual Rainfall Summary
Source: National Weather Service's, Southeastern River Forecast Center
Location: Area 09A, Charleston County

2017	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1	0.36	0	0	0	0	0	1.05	0	0.17	0	0	0
2	0.02	0	0.09	0	0.37	0.05	0	0	1.33	0	0	0
3	0.15	0	0.06	0	0	0.03	0	1.06	0.34	0.01	0	0
4	0.2	0	0	0.72	0	0	0.12	0.23	0	0.01	0	0
5	0	0	0	0	0.39	0	0	1.17	0	0	0	0
6	0	0	0	1.96	0.04	0.42	0	0.63	1.8	0	0	0
7	0.42	0	0	0	0	2.22	0	0	0.2	0.12	0	0.24
8	0	0.17	0	0	0	1.71	0.47	0.58	0	0.02	0	0.7
9	0	0.08	0	0	0	0.01	0.21	0.8	0	0	0.02	0.56
10	0	0	0	0	0	0	0.3	0.98	0.05	0.05	0.41	0
11	0	0	0	0	0	0	0.13	0.81	0.44	0	0	0
12	0	0	0.03	0	0	0	0	ND	5.73	0	0	0
13	0	0	0.01	0	0.01	0	0	0.26	0	0	0	0
14	0	0.22	0.42	0	0.86	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0.24	0.23	0	0	0
16	0	0	0	0	0	0.01	0.04	ND	0	0	0	0
17	0	0	0	0	0	0	2.4	ND	0	0.1	0	0
18	0	0	0	0	0	0	0.39	ND	0	0	0	0
19	0	0	0	0	0	0.09	0	ND	0	0	0	0
20	0	0.02	0	0.04	0	0.01	0.4	ND	0	0	0	0
21	0	0	0	0	0	0.5	0	0.2	0	0	0	0.29
22	1.29	0	0.47	0	0.09	1.11	0	ND	0	0	0.27	0
23	1.36	0	0	0	1.7	0	0	0	0.1	0.92	0	0
24	0.06	0	0	2.69	3.44	0	0	0.07	0	1.27	0.38	0
25	0	0	0	1.28	0.18	0.27	0.51	1.88	0	0	0	0.02
26	0	0	0	0	0	0.34	0.1	0.05	0	0	0	0
27	0.01	0	0	0	0	0	0.56	0.01	0	0	0	0.04
28	0	0	0	0	0	0	0	0.01	0	0	0	0.05
29	0		0.01	0	0	0	0.19	4.54	0	0.09	0	0.08
30	0		0	0	0	0.07	0.63	0	0	0	0	0.01
31	0		0.11		0		0	0		0		0
Total	3.87	0.49	1.2	6.69	7.08	6.84	7.5	13.52	10.39	2.59	1.08	1.99
*Days highlighted indicate 4 or more inches of rain in a 24 hour period.												
* Sample dates are indicated in blue.								ANNUAL RAINFALL 63.24				

2018 Annual Rainfall Summary
Source: National Weather Service's, Southeastern River Forecast Center
Location: Area 09A, Charleston County

2018	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1		0.00	0.02	0.00	0.00	1.05	0.02	0.66	0.00	0.00	0.00	0.00
2	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.10	0.07	0.00	0.08	1.11
3	0.00	0.00	0.00	0.00	0.00	0.39	0.02	0.30	0.00	0.00	0.00	1.85
4	0.97	0.00	0.00	0.00	0.00	0.00	0.63	0.62	0.00	0.00	0.00	0.01
5	0.00	0.44	0.00	0.01	0.00	0.00	0.78	0.97	0.00	0.00	1.16	0.00
6	0.00	0.00	0.00	0.00	0.03	0.00	0.07	0.00	0.01	0.07	0.21	0.00
7	0.00	0.00	0.22	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.07	0.00
8	0.00	0.27	0.00	0.58	0.00	0.00	1.60	0.00	0.08	0.10	0.29	0.02
9	0.00	0.00	0.00	0.01	0.00	1.92	0.00	0.18	0.11	0.11	0.01	1.17
10	0.00	0.37	0.00	0.03	0.00	0.27	0.00	0.34	0.00	1.08	0.25	0.69
11	0.00	0.00	0.00	0.10	0.00	0.65	0.00	0.00	0.04	0.21	0.00	0.00
12	0.09	0.04	0.20	0.00	0.00	0.00	0.00	0.36	0.00	0.03	0.00	0.00
13	0.18	0.08	0.37	0.00	0.00	1.45	0.09	0.00	0.08	0.00	0.85	0.00
14	0.00	0.00	0.00	0.00	0.00	0.01	0.31	0.01	0.00	0.00	0.04	1.15
15	0.00	0.00	0.00	0.05	0.00	0.04	0.00	0.19	0.34	0.00	1.23	2.88
16	0.00	0.00	0.00	0.72	0.02	0.12	0.00	0.00	0.11	0.00	0.00	0.10
17	0.00	0.00	0.00	0.00	0.39	0.00	0.17	0.00	0.00	0.01	0.00	0.00
18	0.00	0.00	0.09	0.00	0.15	0.00	0.35	0.00	0.19	0.00	0.00	0.00
19	0.00	0.00	0.35	0.00	1.01	0.00	0.22	0.13	0.00	0.00	0.08	0.00
20	0.00	0.00	0.18	0.00	0.50	0.00	2.15	0.01	0.00	0.00	0.00	0.38
21	0.00	0.00	0.27	0.00	0.02	0.04	1.01	0.00	0.00	0.21	0.00	0.73
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.22	0.00	0.00	0.16	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
24	0.00	0.01	0.00	2.73	0.25	0.00	1.06	0.00	0.00	0.00	0.48	0.00
25	0.00	0.00	0.04	0.00	0.03	0.82	0.25	0.00	0.02	0.00	0.13	0.00
26	0.00	0.19	0.01	0.00	0.00	0.06	0.95	0.00	0.03	0.09	0.00	0.00
27	0.00	0.00	0.00	0.00	0.03	0.00	1.29	0.06	0.00	0.16	0.19	0.00
28	0.01	0.00	0.00	0.00	1.10	0.44	2.00	0.05	0.94	0.00	0.00	0.13
29	0.82		0.00	0.00	0.39	0.00	0.30	0.02	0.06	0.00	0.00	0.38
30	0.00		0.00	0.00	0.67	0.00	2.11	0.00	0.14	0.00	0.00	0.00
31	0.00		0.17		0.07		0.25	0.00		0.00		0.00
Total	2.29	1.40	1.93	4.39	4.66	7.26	16.08	4.00	2.22	2.07	5.07	10.60
*Days highlighted indicate 4 or more inches of rain in a 24 hour period.												
* Sample dates are indicated in blue.									ANNUAL RAINFALL		61.97	

TABLE #6

**Shellfish Management Area 09A
Pollution Event Closures
2016-2018**

Event	Date(s)	Sample Date(s)	Opening Date	Comments
Hurricane Matthew	10/07/2016	10/17/2016	10/19/2016	Growing Areas closed prior to Hurricane Matthew.
Sewer Overflow	10/08/2016	10/31/2016	11/04/2016	2,000 Gallon SSO IOP
Sewer Overflow	10/08/2016	10/31/2016	11/04/2016	5,000 Gallon SSO Sullivan's Island/Harbor SSO's
Tropical System From Hurricane Harvey	8/29/2017	9/25/2017	10/15/2017	Event produced 4.54 inches of rain in a 24 hour period.
Hurricane Irma	09/12/2017	09/25/2017	10/15/2017	Event produced 5.73 inches of rain in a 24 hour period.

TABLE #7
Shellfish Management Area 09A
MARINA INVENTORY

Marina	Total Slips	Pump-out Facility	Fuel Dock
Two Islands Marina	25	No	No
Long Island Yacht Harbor	22	No	No
Toler's Cove	152	Yes	Diesel-Gas